"Annales," which has just appeared, devoted mainly to meteorological and climatic inquiries, is perhaps of a modest character viewed from a scientific standpoint; but it shows that the present director, M. Eginitis, is alive to the importance of creating a broader scientific interest throughout the country, which may be productive of greater energy and lead to the establishment of a well-supported institution. If this be the intention of the director, the means he has employed are excellent. For M. Eginitis has endeavoured to interest a number of the better instructed class, such as civil engineers, professors of mathematics in the colleges and schoolmasters, in meteorological and seismological inquiries, and has induced the Government to provide a simple instrumental equipment at stations where it could be properly employed. The result is that he has distributed throughout Greece and the Ionian Isles a number of centres whence climatic observations are regularly forwarded to the central observatory at Athens and there reduced.

The results for the years 1894–9 are printed in this volume, and we regard the fact that the dormant energies of a large number of people are interested, and the habit of continuous observation encouraged, as of greater importance than the actual observations collected. The public is being trained to expect a certain amount of scientific work from the Government officials, and demands for a further advance will be made and will be granted, when urged by competent observers backed by a growing scientific opinion. We would urge M. Eginitis steadily to pursue the methods which he has introduced, and which cannot but be productive of a lasting and beneficial result.

Two memoirs from the director accompany the volume, one a discussion of the observations of meteors made at the observatory, the other on the distribution of earthquakes throughout the day and year as recorded at the Grecian stations. In 1899, M. Eginitis reports 567 earthquake shocks, of which 271 occurred in the spring against 62 in the summer months, and this peculiarity is in general agreement with a more extended inquiry embracing the period 1893–8. With regard to the relative position of the earth and moon, in which the latter might be presumed to have some slight effect in displacing the arrangement of internal rocks as the consequence of a tidal flow, M. Eginitis finds that there is no noticeable connection between the frequency of seismic disturbance and the position of the moon in its orbit. A description of the effects experienced on the occasion of the earthquake at Triphylie on January 22, 1899, concludes this section.

VIBRATIONS OF BRIDGES.

THE last volume issued by the Earthquake Investigation Committee of Japan published in a foreign language is "On the Deflection and Vibration of Railway Bridges"—a subject which, although not seismological, is an excellent illustration of investigations which seismologists have been tempted to pursue.

The author, Dr. F. Omori, experimented on twelve railway bridge girders, the spans of which varied between 20 and 200 feet. The instruments used to record the bridge vibrations were a pair of seismographs such as are used for recording horizontal motion, and a horizontal lever seismograph for vertical motion. This latter instrument is here called a *deflectometer*. The quantities measured were the *deflection* of girders, or the total amount of bending caused by the passage of rolling stock, and the vertical transverse and longitudinal *vibrations*, which latter are almost *nil* when the speed of a passing train is either very slow or at a maximum, when the speed has a certain value. The incentive to this work was a question respecting the stability of the Rokugo-*gawa* Bridge, which was the first large bridge built in Japan. It was put up in 1875, a time when the rolling stock was somewhat lighter than that now in use. Oddly enough, the vibrations and deflections of this same bridge, and also others, were investigated in 1895 with apparatus similar to that now employed, and had Dr. Ōmori known this, it is possible that he would have compared the apparent state of the bridge at that date with what it was found to be five years later.

An account of this earlier work, with reference to that of others, as, for example, the seismometric measurements made by Prof. J. A. Ewing on the new Tay Bridge, will be found in *Engineering*, January 24, 1896.

The mechanical time marker used to determine the speed at which the record-receiving surface was moved, which is a determination of great importance when estimating vibrational periodicities, is apparently very similar to a contrivance largely used in seismometry in 1882 (see *Trans.* Seis. Soc., vol. iv. p. 97, Fig. 8).

A point not touched upon is a comparison between values given to displacements as measured by seismographs and as determined by the direct methods employed by engineers. Previous investigators have done a little in this direction, but before the confidence of the practical man can be obtained it is clearly necessary that this work should be extended. The results which, however, have been arrived at respecting the strength and rigidity of various types of iron girders by this neglected method of investigation appear to be worthy of consideration by the builders of bridges. In the *Erdbebenwarte* of last year there are three notices of Dr. Ōmori's important and carefully conducted investigations, which are now followed by the advertisement of an instrument maker who is prepared to supply engineers with apparatus designed for this particular class of work.

J. M.

REPORT ON UNIVERSITY COLLEGES.

A REPORT upon the work of university colleges has been issued as a Blue-book and contains much information as to the provision for higher education in various parts of the country. An annual grant of 25,000*l.* is made by the Government in aid of certain university colleges, and the character and quality of the work done, with special reference to the difference between work of an elementary character and that of a more advanced nature, is tested by occasional inspection.

A visit of inspection was held in 1896 by Mr. T. H. Warren and Prof. G. D. Liveing, and another was made last year by Dr. H. G. Woods and Dr. Alex. Hill. The colleges visited were:—University College, London, King's College, London, Bedford College for Women (University of London), the Owens College, Manchester, University College, Liverpool, Yorkshire College, Leeds, the University of Birmingham, University College, Bristol, Durham College of Science, Newcastle-on-Tyne, University College, Nottingham, Firth College, Sheffield, University College, Dundee, Reading College, the Royal Albert Memorial College, Exeter, and Hartley College, Southampton. As has already been announced, the Reading College and the Hartley College, Southampton, have only recently been added to the list of university colleges, of which there are now fifteen which participate in the Government grant.

The present report is almost entirely made up of descriptions of the buildings and laboratories of each of the colleges, main lists of work, organisation, and position of various departments of arts and sciences. Preceding this is a general statement by Drs. Wood and Hill, and following it a report by Mr. H. Higgs upon the financial position of the colleges. A few of the points touched upon by Drs. Wood and Hill are mentioned below.

Plan of Buildings.—Anyone who makes the round of the university colleges is certain to develop in his own mind an ideal scheme of college buildings. Our own observations have led us to the conclusion that it is a mistake for a college to invest a large portion of its capital in buildings which cannot readily be adapted and extended to meet changing needs. We could cite cases in which much money has been spent upon the material fabric of a laboratory, whereas the want of funds to provide an adequate modern equipment seriously reduces the effectiveness of its work. The demands of science are constantly changing. It is therefore desirable that funds should be so husbanded as to allow of the provision of new apparatus and appliances of all kinds as they are called for. In this connection we feel that it is not too much to say that we have seen no single college in which adequate funds were available for departmental expenditure. A few departments of particular colleges which have been housed and equipped by private munificence are notable exceptions, but in the large majority of cases the funds assigned to departmental libraries, apparatus, lecture illustrations, &c., are altogether insufficient.

Statistics of Progress.—The general result of our observations and inquiries is to show that very remarkable progress has been made by the university colleges during the last five years. The great, we might almost say immense, growth is proved by the following statistics:—(1) The total amount of the benefactions

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received during the last five years by the twelve colleges which participate in the grant amounts to close upon one million sterling. (2) The total number of day students attending the colleges during the session ending in July, 1901, was 7825, as against 7186 attending during the session ending July, 1896. (3) The advance in the standard of work is more striking than the advance in numbers. This advance is best shown by the larger number of university degrees obtained by students. The aggregate figures for the two periods are as follows:—1891-6, 1437 degrees; 1896-1901, 2186 degrees.

Position of Teachers.—Nothing has impressed us more than the enormous amount of routine work which the majority of university colleges exact from their teachers. There are, it is true, several exceptions. In certain colleges and in particular departments in which the number of students is small, the professors and their assistants have a good deal of leisure, and are able to undertake literary and scientific work with the support, in some cases, of fairly satisfactory libraries and laboratory appliances. In the larger and more successful colleges and departments the pressure upon the time and thought of the teachers is unduly great. If the head of a department is to maintain a high standard of teaching and to ensure a creditable list of examination successes he has little leisure for private work, and especially is he obliged to be assiduous in his duties because the students of the university colleges belong, for the most part, to a social class which exacts the maximum return in results for the fees paid. As to the effect of too much work upon the teacher there is no room for doubt. It tends to sap his intellectual vitality by leaving him neither time nor energy to draw fresh inspiration from the study of the work of others or from his own investigations. A fresh and unharassed mind is, above all things, necessary for research.

There is another respect in which, as it appears to us, the colleges are not serving their own best interests by overworking their teachers. The stipends which they offer are, for the most part, distinctly moderate. The opportunities for continued study and research are, except in London, inferior to those which Oxford and Cambridge afford. It can hardly be expected, nor is it to be desired, that a man of real capacity should look upon an appointment at a provincial college as a settlement for life. Rather should he regard it as a stepping-stone to preferment. If the colleges were to realise that the smallness of the stipend which they offer would be more than compensated in the eyes of an ambitious man by larger opportunities of qualifying for preferment, they would attract to their service young men of the greatest promise. If the probability of the advancement of its professors and lecturers to more lucrative and important posts is kept in view and their duties so arranged as to allow them leisure to display their capacity for original work, the colleges may count upon a supply of young men of the greatest ability who will occupy their chairs for a certain number of years while waiting to be called to a wider sphere.

Research.—We have found it difficult to give any adequate idea of the amount of original research in science which has been carried out by the teachers and students of the several colleges during the quinquennium under review. The greater part of the research work carried out at provincial colleges is done by heads of departments, and we recognise that a summary of each professor's own work would have greatly increased the value of our report. For several reasons, however, we have not felt ourselves at liberty to attempt this. In the first place, the leisure and, therefore, the opportunities for research, which the professors enjoy vary immensely. In the majority of cases we should say that the professor's duties are far too arduous and incessant to allow him to do much work of this kind. In the second place, we find that certain professors hold that it is the duty of the head of a department to work through his students. To them he conveys his ideas and affords constant assistance in carrying them out. A teacher who adopts this point of view may publish nothing under his own name, although all the work which emanates from his laboratory is really inspired by him.

Students and Original Research.—With regard to the question of the desirability of encouraging students to undertake original investigations, we find that teachers hold diametrically opposed views. Some consider that to set a student to such work is to rob him of the opportunity which his student days afford of acquiring information. Others look upon experience in research as the best training which any student can receive. The amount of research work done by students depends, therefore, to a certain extent upon the position which professors take with regard to this question. It may also be noted that the effort and originality required to produce "a paper" in some subjects is very different from that required in others. Probably the scope for original work in science is greatest in chemistry and least in physiology. In chemistry, too, the making of new substances and the investigation of interactions is a training in the science to a much greater extent than is similar work in any biological subject.

University Colleges and Secondary Schools.—We find that the relations of the more important provincial colleges to the secondary schools of their districts have become distinctly closer in the last five years. Not merely do more pupils pass from the secondary schools to the colleges, but reciprocity of representation on the governing bodies of schools and colleges is becoming more frequent, and there has been a certain amount of inspection of secondary schools carried out by members of the staff of several of the colleges. Another significant fact is that there have been of late several instances of denominational colleges, especially training colleges for the Nonconformist ministry, settling near university colleges in order that their students may attend university courses in arts and science. These facts point to the increasing importance of university colleges as educational centres.

University Colleges and Technical Education.—In an ever-increasing degree the university colleges are serving to co-ordinate the various agencies for higher education into an effective whole. They serve to focus educational forces. Particularly is their integrating action noticeable on the technological side, and although their results in this direction are not the phases of their activity which we were commissioned to investigate, they are, in our opinion, so desirable that we venture to call attention to them. Technical institutes are growing up in all large towns. When they are not in direct connection with the university colleges, where such exist, there is inevitably a certain amount of rivalry, with consequent friction, overlapping and waste of energy. The scientific direction of technological studies is a matter of national importance. In the technical departments of a university college, technical education is lifted to a higher plane. The head of a technical department, who is also a member of a college staff, and in close touch with the heads of departments of pure science, takes a higher and wider view of his own work, and inspires a more scientific spirit in his pupils. Further than this, the more capable of his pupils have the opportunity of prosecuting the study of the pure sciences as far as their inclination or financial resources allow. Not infrequently they discover in themselves an aptitude for science which would never have been suspected had they not joined a technical department for the purpose of acquiring instruction which would enable them to earn a living. In departments which would at first sight appear to be the most distinctly technical, we found that researches were being prosecuted which were helping to solve questions of general interest to men of science, the results reaching far beyond the interest of the particular industry to which the department belonged. Every year the boundaries which separate pure science from applied science become more indistinct. The physicist, the chemist and biologist make discoveries which prove to be unexpectedly useful in their application, while the technologist, going farther and farther afield, undertakes researches, the applications of which he cannot foresee, in the hope that he may light upon results which commerce can turn to account.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE pass list of the D.Sc. examination of the University of London contains the following names:—Mixed mathematics, Louis N. G. Filon (Granville scholarship); experimental physics, G. J. Parks, W. Watson; chemistry, R. H. Aders, R. M. Caven, C. H. Desch, E. J. Russell, J. Wade, Martha Annie Whiteley; botany, F. E. Weiss; zoology, H. S. Harrison (Sherbrooke scholarship), H. H. Swinnerton; physiology, Florence Buchanan, F. G. Hopkins; geology, C. A. Matley, E. W. Skeats.

THE Annual Calendar of the McGill College and University, Montreal, for the session 1902-1903 is a volume of more than four hundred pages filled with details of the buildings and equipment of the various departments, and the courses of work

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